Periscope.

a.—ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM.

FUNCTIONS OF THE CEREBRAL CORTEX.—At a recent session of the French, Acad. of Sciences (rep. in *L'Union Medicale*, No. 89, July 29), M. Vulpian, read a communication of M. Bochefontaine, on the effects of faradization of the cerebral cortex, which, in substance, was as follows:

"The experiments of MM. Fritsch and Hitzig, reproduced by numerous experimenters, have shown that galvanic, or faradic excitation of certain points of the gray cerebral cortex, causes movements in various parts of the body, and particularly in the members.

"Basing themselves on these results, different authors, adopting the opinion of MM. Fritsch and Hitzig, have considered these points of the brain as centres for voluntary motion; but not all physiologists have adopted this interpretation of the experiments in question. M. Vulpian has many times declared during his course, that he did not care to go at present beyond their immediate signification. These experiments according to him, prove only one fact beyond doubt; *viz.*, that certain parts of the cerebral hemispheres are excitable by electricity; and from certain indications, he has expressed the idea that the electrization of the points designated as centres for voluntary movements of the members, ought to act on all the organs, the activity of which is called out by reflex action under the influence of the excitation of sensory nerves.

"It is this idea that has induced me to study, in the dog, the influence of faradization of the points called *centres for voluntary movements of the members* on different apparatuses of organic life, which are not directly under control of the will. Some of the experiments relative to the circulation, and the secretion of the sub-maxillary gland, were made in collaboration with M. Lepine in M. Vulpian's laboratory. The other researches were undertaken by me alone.

1. "By means of the mercurial kymographion, it is established that faradization of the so-called motor centres for the limbs, produces generally an elevation of the intra-carotidian blood pressure of from 14 to 16 centimetres. At the same time, the cardiac pulsations are slowed sometimes, under the influence of only one excitation, we observe alterations of acceleration and retardation of the pulse, and the mean tension feeling the oscillations, though all the while higher than before the faradization. Such is the course of the phenomena when the nervous system is intact.

"It is well known that the pressure rises and the pulse is accelerated, when both vago-sympathetics are divided in the neck. If we then faradize the gyrus, the arterial tension still rises, but the cardiac systoles are slowed.

"In many experiments the section of the vagi alone, between the superior cervical ganglion and the base of the cranium, modified the effects of faradization of the brain. The blood pressure, instead of increasing, at the moment of faradization, was lowered from 4 to 5 centimetres, and the pulse was slowed.

2. "It is known that faradization of the sigmoid gyrus causes an immediate and considerable dilatation of the pupil. In an animal, whose cord had been cut across in the cervical region, this faradization still caused a rapid dilatation. But in this experiment the excitation could not have followed the course of the cervical sympathetic; it is probable that it reached the encephalic isthmus, whence it was conducted to the ophthalmic ganglion of each side by the sympathetic nervous fibres coming from that part of the encephalon.

3. "Faradization of the brain causes hyper-secretion of the parotid and sub-maxillary glands, to the degree of immediately doubling the quantity of saliva from these glands. This fact may be utilized in physiology to collect the parotidian saliva.

4. "The stomach and intestines are influenced by stimulation of the centres for the members.

"The pyloric portion of the stomach contracts strongly for an instant; then the peristaltic and the anti-peristaltic movements are retarded, or suspended. I have observed these results with M. Leven.

"The intestinal walls contract in an irregular manner.

5. "The bladder contracts and expels more or less completely the contained urine.

6. "The spleen contracts so as to diminish to one-third of its former volume.

7. "If we insert canulas into the ductus choledochus, and the duct of Wirsung, also those of Steno and Wharton, we perceive that the bile and pancreatic fluid cease to run when the faradic current is passed through the sigmoid gyrus, while the parotid and sub-maxillary glands secrete abundantly.

"All these facts concur to prove, that faradization of the points called *motor centres for the members*, acts on the various apparatuses of organic life. Therefore, while even we suppose that these parts of the gray cortex, are the seats of excitory power for the voluntary movements of the limbs, we are led to attribute to them another order of functions, as the same irritation simultaneously provokes the activity of the muscles of organic life (vessels, iris, spleen, for example), and the glands, such as those for secreting the saliva.

"But we must say that all these facts, those which concern the movements of the limbs, as well as those of which this communication treats, do not prove that the gray cortex is excitable by faradic currents.

"In fact, it is necessary in order to produce these effects that the faradic current employed should be rather strong. The current that causes movements of the members and contracts the spleen when applied to the convolution of the gyrus; this same current stimulates the radial nerve through the tissues that cover it, at the level of the lower third of that nerve, in such a way, as to provoke contraction of the muscles animated by that nerve. It is beyond doubt that the faradic current diffuses itself through the tissues, as well as those of the brain skin and muscles, as is proven, moreover, by the galvanometric experiments of MM. Carville and Duret, and in consequence, we are justified to attribute the effects produced, not to excitation of the gray substance, but to that of the white matter below it.

"We may admit that in the white substance situated below the parts experimented upon, those are excitable fibres in relation, by their deep terminations, with the direct centres of excitation of the muscles smooth and striped, and the glands. These fibres are irritated by the electric current, and they put in action the excitory centres.

"But if the excitability of the gray cortical substance is not demonstrated by all the experiments, the existence of motor centres for the members, localized in special parts of this substance is no better proven, and needs to be supported by further facts to be put beyond doubt."

Goltz, *Pflueger's Archiv.* XIII., I, May, 1876, publishes a lengthy article detailing his experiments on the brains of animals. His method was to trepan the skull, and wash out portions of the brain substance with a jet of warm water, the vessels being, to a great extent, avoided by this procedure. He thinks from these experiments, that the extent of the injury is of more importance than its locality, in causing disturbance of function. Thus, he says, the character of the disturbance is the same, whether the trepanation was performed over the anterior margin of the so-called irritable zone of Hitzig, or back in the region of the posterior lobes. This is not, of course, in agreement with other observers; the reason may be, and probably is, in the comparative coarseness of Prof. Goltz's method. His results are, however, of great interest; the observations were directed to the disorders of sensibility, of vision and of motility, caused by destruction of a portion of the cerebral substance of one hemisphere.

In regard to the first of these, he found that the destruction of a considerable portion of the brain of a dog, caused almost at once, a decided loss of sensibility upon the opposite side of the body; it appeared quite anæsthetic, the anæsthesia diminishing in a short time, but still leaving impaired sensibility, especially to pressure.

A considerable part of one hemisphere was removed, by Goltz's method, in a dog. The animal, immediately after the operation, was found to be blind in the eye of the opposed side, which, however, recovered its function in a few days, at least, in part. Still, there seemed to be a defect of vision; objects that formerly excited anger or fear did so no more; he did not appear even to distinguish a piece of meat laid near him on the right. A very interesting series of experiments were performed on another dog, that had been submitted to several of these operations, and the well eye removed. The author, holding that each eye is in relation with both hemispheres, rejects the theory of Lussana and Lemoigne, that visual sensations in such cases have lost their perceptive centre on the opposite side